A SURVEY OF ADVANTAGES AND PROBLEMS ASSOCIATED WITH THE DEVELOPMENT OF INTEGRATED MANAGEMENT INFORMATION SYSTEMS

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BY

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CHAPTER I

INTRODUCTION

Background Information

In recent years, professional management and data processing publications have presented many articles on the subject of computer-based management information systems. Some of these articles extoll the virtues and advantages that can be obtained by top level management through use of such systems. They predict that management information systems will be indispensable tools for the manager of the future. The following excerpts from articles on this controversial subject illustrate this viewpoint.

> By the mid-1970's, unless managers use management information systems in their daily conduct of business, they will find themselves incapable of performing management tasks.[1]

> As more and more companies develop information systems, it becomes increasingly necessary to install one. The alternative is to lag behind the competition. Improved market forecasts, sensible inventory levels, fast service, and low overhead will allow companies with Management Information Systems to increase their share of the market at the expense of their less prepared competitors. Thus, developing an information system is not "jumping on the bandwagon"; it becomes a necessity for continued success, if not survival itself.[2]

> What are the prospects of real-time systems, say, 15 or 20 years from now? Some experts believe that, by that time, staff assistants to top management will have largely disappeared. Not only will the staff have disappeared, but so

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[1] Earl C. Joseph, "The Coming Age of Management Information Systems," Financial Executive, August, 1969, p. 45.

[2] R. L. Martino, MIS-Management Information Systems (Wayne, Penna.: Management Development Publications, 1969), preface.

> will most of the paper that flows through present organizations. A manager in the year 1985 or so will sit in his paperless, peopleless office with his computer terminal and make decisions based on information and analyses displayed on a screen in his office.[1]

Other writers describe the many pitfalls and problems associated with developing a truly integrated management information system; presenting a long list of failures and shortcomings in current attempts at implementing such systems. The following excerpts from authors expressing this view, suggest such systems are not worth their associated costs.

> What management ultimately expects is a total system that will instantaneously provide all managers-at every level from plant foreman to chairman of the board-with every fact they need to know in order to make a decision.
>
> But is this possible? And do the results of MIS justify all the money and time that have been poured into it? Probably not. Despite some reported successes, management's headlong commitment to MIS does not seem to have been worth the effort-at least so far.
>
> Indeed, to many line executives who are faced with tough decision-making problems, MIS seems to be creating more problems than it solves. As A. R. Zipf, executive vice president of Bank of America recently told a seminar at Harvard: "We have seen over the past twelve years some incredible blunders. Twinkling lights, spinning tapes and pastel cabinets seem to have a mesmerizing effect on some managers. In a pell-mell rush to be among the first to play with a new toy, enormous sums have been wasted".[2]

> Today's businesses are categorized by their managements as being modern, due primarily to their acquisition and utilization of computing equipment. On the contrary, the proliferation of specialized technical knowledge has turned the modern corporation into a bewildering complex collection of special departments, computer centers, training centers, programming groups, systems and procedures

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[1] John Dearden, "Myth of Real-Time Management Information," Harvard Business Review, May-June, 1966, p. 132.

[2] Arlene Hershman, "A Mess In MIS?" Dun's Review, January, 1968, p. 26.

> departments, and the like .... The fact that computer costs were, in the past decades, unmeasurable and to a large extent unaccountable - as well as the strong possibility that computer costs were considerably higher than manual methods - did little to dissolve the corporate computer romance.[1]

It is the purpose of this study to review and discuss this controversial question of whether or not the achievements of management information systems justify the prodigious amounts of money and energy expended in their development. In the process of studying this issue it is considered desirable to point out the many advantages associated with computer-based management information systems and to present a survey of the characteristics and capabilities of the more prominent generalized data management systems.

In exploring both sides of this issue, it is also considered advantageous to illustrate the many problems and causes of failures in the development and implementation of such systems.

Finally, through research and review of current publications, this paper will present the cogent viewpoints of prominent individuals in the data-processing and management fields on this controversial subject.

Statement of the Research Question

What are the advantages to be realized and the pitfalls often encountered in the development of integrated management information systems? It is the intent of this thesis to identify and weigh the relative merits of the potential benefits to be gained by the development of truly integrated management information systems, in relation to

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[1]Howard Bromberg, "Revolution 1970," DATAMATION, January, 1970, p. 32.

the high cost and high incidence of failure that is often encountered.

Through investigation of the purposes and objectives of integrated management information systems, and through a study of the characteristics and capabilities of operational systems, as well as the more prominent generalized data management systems, this thesis also seeks to reveal the potential pitfalls encountered in management information system development, and to point out the most beneficial attributes to be obtained from implementation of these systems.

Consideration of the following subsidiary questions is designed to aid in the development and structure of this thesis:

1. What is a computer-based management information system, its purposes, advantages and goals to be accomplished?

2. What are the characteristics and capabilities of the more prominent generalized data management systems?

3. What are the many pitfalls encountered in development and implementation of computer-based management information systems?

4. What are the prevalent views on the efficiency and cost effectiveness of management information systems?

Scope of the Study

It is intended that this thesis will research the established objectives and goals of integrated management information systems, identify the advantages to be attained by their development and use, and pursue the topic of the many dangers that must be avoided in order to arrive at a truly integrated, viable system. A study of the more prominent generalized data management systems will be made in order to identify individual characteristics and capabilities and to evaluate

the generalized systems' potentials in relation to systems developed for a unique application. An exploration of the current viewpoints of prominent individuals in the data-processing and management fields will be reviewed to identify the current feeling concerning the relative merits of integrated management information systems.

No attempt will be made to study all aspects of the management information field exhaustively, or to cover all the currently developed and emerging generalized data management systems. The project will seek to be general in nature and to cover only the more important and well accepted ideas, except where specific consideration can be made of existing generalized data management systems, and where specific examples of system failures and successes can be attributed to identifiable organizations and situations.

Purpose and Utility of the Study

It is another purpose of this study to review and discuss the controversial question of whether or not the achievements of management information systems justify the prodigious amounts of money and energy expended in their development. Through the study of this question, it is expected that a more thorough understanding of the goals and objectives of integrated management information systems will emerge. It is also intended that a study of the many benefits attainable, as well as the counter-balancing dangers and pitfalls that can be encountered, will act as an educational tool and will provide knowledge and experience that will prove valuable in future encounters and positions dealing with management information systems.

The enumeration and discussion of the opinions and experiences of those who have attempted to develop management information systems, and the presentation of the causes for their success or failure, are intended to provide information that can be used to aid in avoiding the pitfalls and ultimately to lead to the successful development of an efficient, cost effective, and indispensable tool of management.

Research Methods Utilized and Methods of Analysis

This research project also provides an academic discussion of the relative merits and problems of management information systems; therefore, research will be confined to secondary sources only.

Secondary sources include local university and government libraries and selected periodicals.

The method of analysis used in this project will be the deductive technique. The scope is considered indicative and by no means exhaustive. Any areas encountered that indicate further research is desirable are properly noted and justified.

Organization

Chapter II will provide a definition of computer-based management information systems, and will identify the purpose, general characteristics, and advantages to be reached from their proper utilization.

Chapter III discusses the characteristics and capabilities of prominent generalized data management systems.

Chapter IV identifies and discusses the common pitfalls encountered in the development and implementation of computer-based management information systems.

Chapter V presents some prevalent views on the efficiency and cost effectiveness of computer-based management information systems. Pertinent comments from those who question the value of such systems, as well as comments from the advocates of such systems, are presented.

Chapter VI summarizes the pertinent points of the paper, and provides conclusions based on deductive reasoning.

CHAPTER II

WHAT IS A COMPUTER-BASED MANAGEMENT INFORMATION SYSTEM?

The Definition and Purpose of a Computer-Based Management Information System

There are probably as many definitions of what a Management Information System (MIS) is as there are books and articles on the subject. Mr. Leonard I. Krauss relates a story about the chairman of a business seminar on MIS who, at the start of the seminar, asked the 15 systems executives and analysts present for their definition of an MIS, and received 15 different definitions in response. At the end of the seminar, he again asked the 15 people present for their, hopefully clarified, definition, and received 16 different definitions this time. Apparently, one individual had acquired so much information from the seminar that he now felt compelled to define MIS in two distinctly different ways.[1]

Even with this apparent diversity of opinion, however, most definitions have basically similar components but with varying degrees of explicitness. Mr. Krauss indicates that MIS in its basic form is "the integration of the computer with management decision-making process."[2] Another, more involved definition states:

> We will define a management information system as any system that has these three attributes:
> -measures the impact of decisions - either before or after they are made,

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[1] Leonard I. Krauss, Computer-Based Management Information Systems (New York: American Management Association, Inc., 1970), p. 1.

[2] Ibid., p. 3.

> -measures the environment - because we can neither control nor forecast the effect of changing external circumstances,
> -reacts in an appropriate time-frame - to enable us to learn of the development of potential trouble areas in time to make meaningful action.[1]

More restrictive definitions require much more of MIS. Sherman Blumenthal states:

> Since a major purpose of management information and display is to measure performance against a plan, well designed displays should suggest action, emphasize deviations from plan, direct thinking toward objectives, clearly indicate the present position relative to the desired goal, and indicate the probability of reaching the goal.[2]

Many more definitions can be extracted from the myriad books and articles on the subject of MIS, but the purpose of all these definitions is simply to identify (in clear and concise terms) exactly what Management Information Systems are intended to accomplish. In other words, the definitions help to clarify the purpose of these management information systems. But what is the purpose of MIS? Just exactly what does management really want to obtain from utilization of an MIS? In one word, it is information. To go one step further, it is the right information presented at the right time. But the word information is very misleading. It can mean different things to different individuals. Some individuals confuse data with information and operate under the assumption that the more data or information available to the manager, the better the decision he reaches must be.[3] Peter Schoderbek states:

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[1]Martino, MIS-Management Information Systems, p. 28.

[2]Sherman C. Blumenthal, "Management In Real Time," Data Processing Magazine, August, 1965, p. 19.

[3]Peter P. Schoderbek, Management Systems, (New York: John Wiley & Sons, Inc. 1971), p. 174.

> Since the use of costly computers, which is currently the fad, must somehow be justified, there is a tendency to have them generate as much data as possible, irrespective of the utility or cost of the output.[1]

As a result, misguided organizations look upon the computer and the Management Information System as a massive report generator mechanism. Their idea, apparently, is to have reams of material issue from the machine to be pored over by managers with the result that most of their time is spent hunting, not thinking. This obviously is not an example of information.

Schoderbek clearly distinguishes between data and information. He indicates data is an accumulation of facts and material which are to be used inferentially but have not been evaluated as to their worth to a specified individual in a particular situation.[2] In his view, information is, on the other hand:

> ...inferentially intended material evaluated for a particular problem, for a specified individual, at a specific time, and for the explicit purpose of achieving a definite goal.[3]

To sum it up then, a computer-based Management Information System can be concisely defined as "the integration of the computer with management decision-making process."[4] Its purpose is to:

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[1] Ibid.

[2] Peter P. Schoderbek, Management Systems (New York: John Wiley & Sons, Inc., 1967) p. 44.

[3] Ibid.

[4] Krauss, Computer-Based MIS, p. 1.

> ...provide management at all levels with all relevant but no other data, in the most easily assimilated form, at the precise moment when a policy decision has to be taken.[1]

The General Characteristics of an Integrated, Computer-Based Management Information System

Computer-based Management Information Systems have been identified as the means of integrating the computer with the management decision-making process, and it has been pointed out that their general purpose is to provide the right information at the right time. But, this does not adequately explain the general characteristics of an integrated, computer-based Management Information System.

The Management Information System is the nerve center of an organization. It is the means by which the money, manpower, materials, machines and facilities are molded together so that they can function as an integrated whole. It performs this integrative role by: 1) providing information to the various branches of the organization and indicating the impact their individual actions have on the whole, 2) establishing sensors and control measures for data acquisition required by all segments of the organization, 3) maintaining central data banks that can be utilized in the decision making process, and 4) generating output information on demand and on an exception basis that reflects the operation of all segments of the organization, including the management information system.[2]

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[1]F. I. Musk, "One Man's Meat: Part 2 - Now Let's Pretend," The Computer Journal, Vol. 9 (November, 1966) p. 213.

[2]Robert G. Murdick and Joel E. Ross, Information Systems for Modern Management (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971)p. 158.

But what are the elements used to perform this integrative role, and how are they used to accomplish their function? Murdick and Ross identify the elements as procedures, equipment, information and people.[1]

Procedures are the detailed and formal instructions for operating the system. They assign duties and responsibilities, and identify the tasks to be performed. They should be flexible enough to provide for easy assimilation of new systems that may be required as a result of changes and problems that may arise. Procedures include such things as input/output documentation, program flowcharts, computer programs and instructions for operating the system after it is installed.[2]

Equipment in a computer-based management information system means, of course, the computer, and its related equipment. Today there are third generation computers with enormous and (in relation to previous computer generations) inexpensive storage capacities, increased operating speeds measured in nanoseconds, and the newly developed display mechanisms that provide the user with on-the-spot visual interaction with the computer. With these new peripheral display devices, the manager can now interrogate the computer directly, without the customary intermediaries of people, devices and procedures with all their built-in delays and increased costs.[3]

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[1] Ibid., p. 162.

[2] Ibid., p. 160.

[3] Blumenthal, "Management In Real Time," p. 18.

Information is the cornerstone, the single most important element of any MIS. As indicated earlier, the system should provide information rather than data, that is, evaluated material that is applicable and will aid in the decision making process. In order to identify and design an efficient MIS, the relevant information must be distinguished from the irrelevant. The information needs of each executive must be determined. This requires a thorough understanding of the role, responsibilities, authority, and relationships with others, of each potential system user. In defining information requirements, it is seldom effective to ask openly the executive what information he requires,because in many situations he really won't know or he may confine his requirements to standard reports and the traditional accounting data so often used. This narrow view of what constitutes information available in a management information system excludes information about the future, information expressed in non-financial terms such as share of the market and adequacy of customer service, and information about the environment in which the organization must survive such as population growth and the size of the Gross National Product. These are the elements that may really determine the competitive success of the organization.[1]

Martino indicates:

> ...that decision-making requires a bilateral flow of information. Information flows to the manager triggering a decision. The decision, which in itself represents information, becomes flow from the manager to the rest of the organizational structure.[2]

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[1]D. Ronald Daniel, "Management Information Crisis," Harvard Business Review, September-October, 1961, p. 113.

[2]Martino, MIS-Management Information Systems, p. 27.

Such a concept indicates that information is needed for more than just the initial decision-making process. What is needed, in addition, is to know what happened as a result of the decision made. In Martino's words:

> We need immediate feedback in the form of measurement against a standard and against meaningful summaries of real data. (We do not want to be smothered with numbers.) We want knowledge and information in the real time of its occurrence or, in other words, in the appropriate time-frame of the action.[1]

The fundamental notion expressed by Martino is that an effective management information system requires a feedback and control mechanism as part of information flow. If the desired output of the system should deviate from the established standard, the MIS should have the capability of sensing the malfunction, and of taking the necessary action to adjust the inputs to correct the deficiency. Although all management information systems ultimately require human intervention in the feedback and control loop, the more sophisticated systems are designed to reduce such intervention to a minimum.[2]

People are the least predictable, the least subject to control, and of course one of the most important elements of the management information system. The people involved in MIS are the analysts, programmers, computer technicians, and manager-users of these systems. The important aspect of people in MIS is that the manager-user must be intimately involved in the design of the system, and cannot abdicate that responsibility to the technicians. On the other hand, the technicians must take it upon themselves to learn more about the functions

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[1] Ibid.

[2] Murdick and Ross, Information Systems, pp. 165-166.

of management and thus acquire a better understanding of the manager's information requirements.[1]

Ultimately, the elements of the computer-based management information system are arranged into a design that will produce the desired objective. Figure 1 presents a clear diagram of a possible management information system as described in this paper. In reviewing the figure, the following description can help one to discern clearly how the different elements and characteristics are integrated into a workable system. The inputs of planning information and other data are transformed by the Management Information System into outputs that are designed to produce information for planning and control. Control is achieved by developing sensors that measure the outputs of the system against predetermined standards of performance, and then generate management reports that track the output status against the standard. If results do not measure up to the standard, information is fed to the Planning Analysis and Control Group which makes the required management decisions to adjust the system based upon decision rules or data contained in the data bank.[2]

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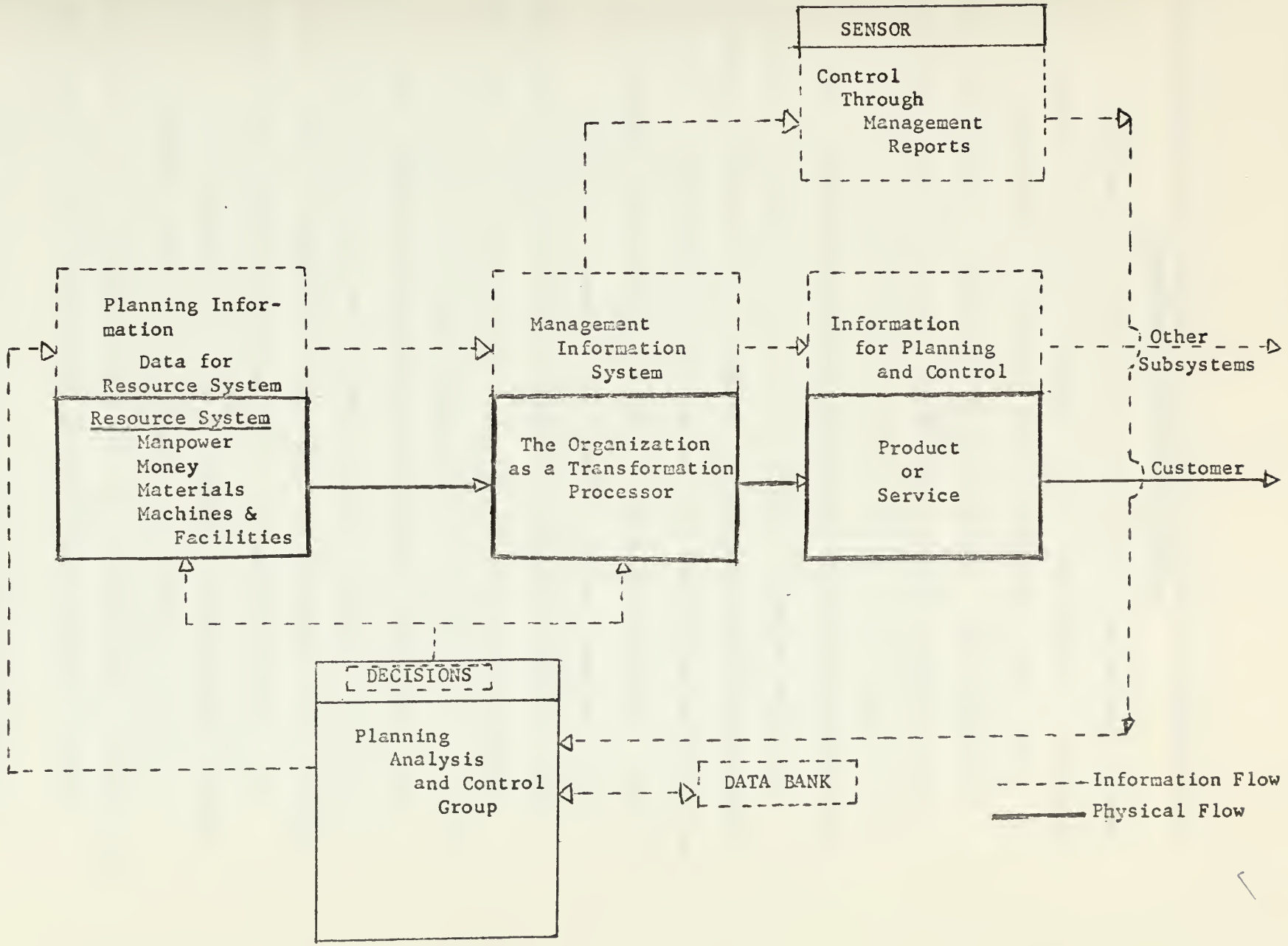
[1] Ibid., p. 162.

[2] Ibid., pp. 163-165.

Figure 1 A Management Information System For Planning And Control

Source: Robert G. Murdick and Joel E. Ross, Information Systems for Modern Management, (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971), p. 164.


SENSOR
Control Through Management Reports
Planning Information
Data for Resource System
Resource System
Manpower
Money
Materials
Machines &
Facilities
Management Information System
The Organization as a Transformation Processor
Information for Planning and Control
Product or Service
Other Subsystems
Customer
DECISIONS
Planning Analysis and Control Group
DATA BANK
Information Flow
Physical Flow

The Advantages to be Reached From Proper Utilization of Computer-Based Management Information Systems

The advantages obtained by a computer-based management information system are almost all a direct result of the coming of the computer and its capabilities of extremely fast manipulation of vast amounts of data and tremendous information storage capacity. The "information explosion" experienced in this century has extremely complicated the task of the present day manager. Without the aid of the computer and its speedy information processing capability, which the computer-based management information system so aptly employs, managers would find themselves ineffective and incapable of performing efficient management functions. The coupling of the computer with information technology has been compared with the impact of Watt's invention of the steam engine.[1]

Timeliness is considered by many as the most important advantage gained by computer-based management information systems. Krauss has said: "If we were limited to choosing the single most important reason for MIS, we would have to name time."[2] The computer's capability of quickly performing routine clerical functions, manipulating, consolidating, summarizing and in some instances evaluating vast amounts of data, and its capability of compiling routine reports, has freed the manager and his subordinates from these time consuming tasks. As a result, the organization effectively employing a computer-based management information system not only acquires the advantage of reduced personnel costs to perform these tasks, but it also finds its manager free to devote his time to appropriate managerial vice clerical functions.

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[1]Oliver W. Tuthill, "The Thrust of Information Technology on Management," Financial Executive, January, 1966, p. 19.

[2]Krauss, Computer-Based MIS, p. 7.

The time-saving attributes of computerized routines allow more up-to-date information to be incorporated into research and evaluation as well as more time for management to study the situation, thus making it possible for him to render faster decisions.

Another advantage, also tied to application of the computer, is the opportunity for more comprehensive analysis. With the computer-based management information system, the manager is no longer forced to "go along" with the one recommendation his subordinates were able to develop in the time allowed. Now he can demand and expect several alternatives to be presented for consideration; all of which have had more thorough examination than the one previously provided solution, because more raw data has been examined and more parameters included in the analysis.

Simulation is another benefit of the computer-based management information system.

> Simulations are in essense trial runs of how things might be done. They invoke models or representations, which are more or less "like" real situations.[1]

They allow the manager to ask "what if..." questions or, in other words, propose possible solutions to a problem; and then "try it out" on the computer in simulated realistic circumstances. The manager can thus see in advance the results that would probably occur if he applied a given solution to the problem. Simulation is considered by many as one of the major contributions of a computer-based management information system. Herbert Klein gives the following evaluation of simulation:

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[1]William F. Boore and Jerry R. Murphy, The Computer Sampler: Management Perspectives on the Computer (New York: McGraw-Hill Book Company, 1968) p. 226.

> Simulation is adding a new dimension to management's analytical powers in many areas of business strategy. By breaking down involved situations into mathematical formulas, plugging them into a computer that selects many possible solutions and then trying them out, it is possible to eliminate costly trial-and-error operations.[1]

The advantages of a computer-based management information system presented so far are aptly summarized by the following list of advantages compiled by Leonard I. Krauss:

1. Render faster decisions.
   a. Detect and authenticate opportunity.
   b. Identify and isolate problems.
   c. Define and analyze situations.
   d. Evaluate and appraise alternative courses of action.
2. Accomplish more in the available time.
   a. Think more deeply about the situation.
   b. Ponder other variables.
   c. Gauge and contemplate ramifications.
   d. Investigate more alternatives.
3. Make more thorough analysis.
   a. Review more meaningful information.
   b. Obtain a better collection of relevant viewpoints.
   c. Use advanced management techniques; that is methods of industrial operations research.
   d. Simulate more conditions.
   e. Ask and examine more questions, particularly the "what if" type.[2]

There are many more advantages to be achieved by proper utilization of computer-based management information systems. Management control and evaluation of the organization can be significantly enhanced, because the executive is allowed to probe more deeply and evaluate more realistically. Moreover, a division's or work unit's work is more readily comparable with that of another or against previously determined plans or goals. Again, this advantage is provided by the computer's capacity for speedy manipulation of volumes of data.

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[1] Ibid., p. 261.

[2] Krauss, Computer-Based MIS, p. 8.

Proper utilization of a management information system is implied by many to mean that the system should be integrated; that is, a common information base should be used by all segments of the organization. As a result, all of the necessary information is available to all of the organization, and individual branches do not have to perform duplicative data collection and maintenance functions. Daniel Couger has stated:

> The two most significant advantages of integration are: (1) the savings in high cost of input preparation, by sharing data among systems; and (2) the improvement in data accuracy and systems reliability by the operation of all systems on common data.[1]

The advent of real-time management information systems ushers in many additional advantages not realized by the conventional "batch-processing" system. Real-time is defined here as the ability to record events, and to react to them as they occur. The more sophisticated real-time systems have incorporated display mechanisms or terminals as a means of communicating directly with the computer. Such systems have the added advantage of allowing the manager to interrogate the computer and receive instantaneous, up-to-date information in response, thus improving further his ability to analyze more deeply and arrive at faster and more sound decisions. Real-time display terminals also provide improved man-machine interaction or symbiosis, allowing him to discourse with the machine in a manner much like the way he would talk to a capable staff assistant in trying to solve a particular problem. The elimination of voluminous hard-copy reports is also an advantage to the manager of a real-time management information system.[2]

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[1] J. Daniel Couger, "Seven Inhibitors to a Successful Management Information System," Journal of Systems Management, Jan./Feb., 1968, p. 17.

[2] Blumenthal, "Management In Real Time," pp. 22-23.

This discussion has presented the more prominent advantages in utilizing computer-based management information systems. Additional advantages might easily be included by others depending on their experience and the type of system they have worked with, but this list is considered sufficient to cover the more significant advantages.

CHAPTER III

CHARACTERISTICS AND CAPABILITIES OF PROMINENT GENERALIZED DATA MANAGEMENT SYSTEMS

The traditional means of developing a computer-based management information system have been to develop a customized system built around the unique operational requirements of the organization involved. The problems with this methodology are that the ill-defined nature of the management function, and the fact that management deals in the unexpected, soon render such customized programs obsolete, or at least in need of frequent modification. The problem is clearly expressed by George Gardner in a recent DATAMATION article:

> However, the use of customized programs has resulted in high implementation and maintenance costs. These costs are high primarily because of the difficulties of making minor changes to the system; if the data base is changed slightly, many of the programs which access the data base must also be changed.[1]

High implementation and maintenance costs are not the only drawbacks, however. In developing a computer-based management information system, it is extremely difficult to predict and define the future problems management will encounter, the information he will require to cope with the problem, and how he will use that information.[2] As a result, the

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[1] George O. Gardner, "Top Management Should Know About the Most Critical Features of Data Management Systems," DATAMATION, 15 October 1971, p. 22.

[2] John A. Gosden and Eugene Raichelson, "The New Role of Management Information Systems" (paper based upon a talk delivered at the UCLA/Informatics Symposium on "Interactive Computers for Controlling Machines and Influencing People: Setting the Specifications for the Fourth Generation," on March 27, 1969), p. 1.

state-of-the-art, until recently, was unable to provide adaptable and responsive systems that were not in constant need of updating and modification. A MITRE Company report clearly defines the kind of management information system required to avoid the above mentioned problems:

> Therefore, a management information system must be general in purpose, highly flexible, and capable of adapting to new needs. In particular, it must be able to deal with three kinds of variety: (1) many diverse kinds of users, (2) many diverse levels of users, and (3) many diverse kinds of data.[1]

In the latter half of the 1960's, many companies began to develop generalized data management information systems in response to the demand for systems that could be installed without the attendant high implementation and maintenance costs, and that were flexible enough to keep pace with the changing requirements for management information, without having to be constantly updated and modified. These generalized systems are based on the premise that certain common functions are found in all computer-based management information systems. Leonard Krauss identifies seven such common functions:

1. Data-base and file creation.
2. Data-base and file updating.
3. Data retrieval.
4. Logical and arithmetic processing.
5. Sorting of records.
6. Merging of records.
7. Report generation.[2]

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[1] Ibid., p. 2.

[2] Krauss, Computer-Based MIS, pp. 180-181.

Realizing that, "all data in all systems had a great deal in common with respect to fundamental processing logic."[1], the designers of these generalized systems developed programs in these common function areas that were broad and flexible enough to cope with many diverse types of information, and that could be controlled by parameters submitted by the user.

The important features of these generalized systems are that they are broad and flexible enough that they do not have to be "customized" to a particular user, or at least they are designed to reduce the customizing to a bare minimum. These "canned" programs can be brought into an organization, and be used to build and manipulate data files at a fraction of the time and cost expended in creating the customized system. The generalized system also provides for more direct interface between the user and the computer, eliminating the costly requirement of translating information requirements to the programmer and waiting for him to develop the system. Through the use of user-oriented retrieval languages, the manager can invoke a wide range of powerful operations without the requirement for the programmer intermediary. Finally, the flexible nature of the generalized data management information systems allows them to better keep pace with changing requirements for files, information and reports.[2]

The remaining section of this chapter will be devoted to identifying the capabilities of some specific, prominent, generalized data

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[1] Ibid., p. 181.

[2] Ibid., p. 182.

management systems. Due to the rapid change of these systems, no attempt will be made to rank or evaluate their relative merits.

COGENT III

This system was developed by the Computer Sciences Corporation for application with the IBM/360 series of equipment. It is the third system in a series of advanced general-purpose data management systems. It is COBOL-compatible and of modular design. Generalized programs have been developed in the common function areas of information storage, maintenance, retrieval and presentation. The system provides for application of unit record, magnetic-tape, direct-access and tele-processing devices.

As in most advanced generalized data-base management systems, COGENT III provides for use of a common data base, accessible by various groups of users. This capability is provided by a single, comprehensive data directory which describes all data used in the system or referenced by it and the relationships between data fields and records.

Users of COGENT III input their requirements by way of an information-system language which is then interpreted by a COBOL language processor and transformed into functional COBOL programs, thereby assuring maximum machine independence. The information-system language allows the user to specify the information to be stored in the data base, its source and how and under what conditions it will be created and maintained. The user also identifies the relationships between different collections of information.

On the retrieval and presentation side, the user specifies who can modify or retrieve data and under what conditions it will be

retrieved. He also determines by what means the information will be processed (i.e., on-line, off-line, batched, real-time or demand processing) and how the information will be presented. The information-system language is designed to be used by various levels of users (i.e., management, operating personnel and system analysts).

COGENT III also provides an interactive inquiry retrieval and storage language for rapid response requirements. With this capability the user can specify and generate a wide range of programs, from the very simple to an entire data processing application or series of integrated applications. Immediate response can be requested or queries can be batch processed.[1]

Data Manager-1 (DM-1)

DM-1 was designed by Auerbach Corporation as a generalized data management software system to be independent of a specific computer. It has been installed on a UNIVAC 1218 for the U. S. Air Force, and on the IBM 360/50 for the Western Electric Corporation.

Basically, DM-1 is a nucleus system built around a job library made up of general-purpose programs for building, maintaining, and querying the data base and job library. The nucleus provides programs for data definition, data structuring, and data access methods. Generalized report generators, user query and maintenance languages, and recording services are not contained in the basic DM-1 design; but are developed for each customer installation, and added to the nucleus job library.

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[1] U. S. Department of Commerce Clearinghouse, Data Management Systems Survey, Pub. No. AD-691-834 (January, 1969) pp. 6-8.

Other user jobs can also be added to the job library as they are developed. The syntax of query and maintenance languages can be defined by the user through a meta-language (translator) similar to ALGOL.

The DM-1 file structure has moved away from the one-level, serial formatted files, and provides a complex linked-tree structure that links data in parent and subsidiary files or master and detail records. It permits a comprehensive system of linking logical relationships of hierarchical structures.

In building files, DM-1 permits the use of variable-length data elements, optional data elements, and nested structures (i.e., basic data elements broken down into more refined sub-elements) through its data description language.[1]

File Organization Generator (FORGE)

FORGE was designed and developed by the Burroughs Corporation for use on its B5000 series of equipments.

As in most generalized data-base management systems, FORGE provides programs for automatic file-building and file-maintenance. In addition, it provides for automatic generation of search routines that enable the retrieval of records from any or all files. Multiple files can be updated as a result of a single transaction, and printed reports can be automatically generated showing the results of maintenance transactions. FORGE also provides the capability for the input of user-defined transactions and generation of user-defined reports.

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[1] Ibid., pp. 3-4.

Burroughs has written FORGE in the COBOL language, and has developed a table look-up technique for organizing and storing data, and for the maintenance and retrieval of information. Through the use of parameter card inputs, the user describes the input and output media, and the structure and content of the data files. FORGE then generates a COBOL-language source program, as a result of these parameter inputs, which accomplishes the desired functions.

FORGE does not have a formal retrieval language nor does it have a formal output-formatting program. Instead, the user has the theoretical capability of writing his own retrieval language and output-formatting program through the input of special parameter cards. These parameter cards can be used to access any of the COBOL procedures available in the Burroughs COBOL system. When used, they are included with the FORGE parameter card inputs, and will cause the successful accessing and processing of the FORGE-generated files.

Information is stored on Burroughs' "head-per-track" disc file. Logical records are stored randomly on these disc files and data items within each logical record are stored contiguously.[1]

Generalized Information System (GIS)

GIS is a third-generation system developed by International Business Machines (IBM) as a replacement for its second generation predecessor, the Formatted File System (FFS). It is designed to be used as a stand-alone system under control of the IBM System 360.

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[1] Ibid., pp. 5-6.

GIS is a set of integrated computer programs designed to perform data file creation, maintenance, retrieval and presentation operations for general application by many diverse users. The GIS user is given a number of generalized processing modules and an information language which provides him with the ability to name files and entries within files and to describe the format and file processing procedures to be performed upon data. GIS also provides a free-form query language that conforms closely to written English. "It is simple for a nonprogrammer to understand and use, yet powerful enough to produce elaborate reports."[1]

The GIS system also provides control and utility features such as:

a) the ability to restrict access to files,

b) a system of providing audit data, during the file maintenance procedure, that can be used for error detection,

c) the capability of detection and recording of data specification, data content and system reaction errors.

GIS also has the ability to handle hierarchical files (i.e., files where records are segregated by levels such as regional sales records being segregated from district sales records) of up to 15 levels of hierarchy, with a single nested group at each level. Finally, GIS has a multi-file capability wherein a maximum of six files can be created, then sorted and queried during any sub-procedure.

The GIS system will be released by IBM in two versions. The first version will contain a majority of the systems capabilities but

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[1]Alan Kreger and Janet Nathanson, "The Tribulations and Triumphs of GIS," DATAMATION, October 15, 1971, p. 21.

will operate in a batched mode vice multiprogrammed environment. The second version will contain additional capability, such as data entry from local or remote terminals, and will operate in a multiprogramming environment.[1]

Integrated Data Store (IDS)

IDS was designed and developed by the General Electric Company for application on its GE 200, 400 and 600 series of equipment. It uses the COBOL Systems language which provides all the features normally available within the COBOL capability. In order to accomodate the IDS structured files, however, some of the COBOL procedures statements have been modified, and other statements have been added to the basic COBOL language.

Utilizing COBOL, the IDS data management system provides a means of generating, maintaining and retrieving data from disc files. The IDS system features, provide the same capability as any specialized input and output subroutines. IDS also provides the user with the capability of specifying the logical structure of the files as well as allowing him some control over the physical structure. The system gives the user the capability of linking together any combination of master and detail records to form an entry. These records may then be stored randomly, since the linking system will connect all groups contained in an entry. The system allows data to be stored physically and sequentially as well.

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[1] U. S. Department of Commerce, Data Management Systems Survey, pp. 13-14.

IDS is controlled by the General Electric multi-programming monitor which provides an on-line remote terminal inquiry capability.

Different versions of IDS are available depending on which series of computers (e.g., GE 200, 400 or 600) is installed. The differences lie primarily in the degree to which COBOL language modifications and additions have been made.[1]

MANAGE

Scientific Data Systems Corporation (SDS) developed MANAGE (full title - SDS 9 Series Manage) for application with its 910, 920, 925, 930 and 9300 computers. MANAGE is a generalized system for generating, maintaining and retrieving data; but it is restricted to application with magnetic tape files only. The tape files must contain fixed-length records, however, record length may vary between files but not within a file.

MANAGE is by far the most restrictive system discussed so far. In addition to the above restrictions MANAGE provides only limited capability to process textual type material (i.e., material containing extensive narrative, such as job status reports, etc.). Such material must be entered into the files in the exact format that it is to be printed. Retrieval capability is restricted in that the data to be retrieved must be identifiable by a fixed-position unique identification code. Record size is limited to a maximum of 15 lines per record and 120 characters per line.

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[1] Ibid., pp. 10-11.

MANAGE is a file-oriented system rather than a user-oriented system, and its application is limited, in comparison to the other systems discussed so far.[1]

MARK IV

MARK IV was developed by the Informatics Company as an advanced general-purpose file management system for application with the IBM/360 series of equipment. It is Informatics' fifth in a series of data management systems.

As in most of the previously discussed generalized data management systems, MARK IV provides the capability for the generation, maintenance and retrieval of information, as well as a comprehensive report generation capability. Unlike most of the systems discussed, however, it can operate from either tape or disc oriented files. As in the other systems, the user identifies his required specifications to the computer (in the MARK IV system structured forms are used for this input), and the computer then generates the desired program through use of pre-coded routines stored in the MARK IV library.

The user specifies the logical organization of the files. When using magnetic tape storage, data is accessed using the Sequential Access Method, and is accessed by the Index Sequential Access Method when disc storage is utilized.

The MARK IV system has file creation and maintenance capability, can select data based on user selected criteria, and can then make

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[1] Ibid., pp. 16-17.

computations on the data in these records. Its retrieval capability allows it to extract data from selected records and produce new files, parts of files, or combinations of files. The MARK IV report generation capability can produce reports in various report formats or can produce reports using preprinted forms.

The MARK IV user can also call up previously generated user-coded programs that are needed on a periodic basis or user-coded special routines for special processing, which have been stored in library.[1]

The National Military Command System Support Center Information Processing System (NIPS)

NIPS is a general-purpose file-handling system developed by the National Military Command System (NMCS) for application in military Command and Control and Intelligence Centers. The latest model, the NIPS/360 is designed to be used on the IBM System 360 computer.

NIPS was developed to perform the traditional functions of structuring, maintaining, revising and retrieving data from data files. NIPS is basically an outgrowth or improvement on a previously developed NMCS system, the Formatted File System (FFS). The NIPS improvements include, an improved query language, an on-line retrieval mechanism, and an expanded logical file maintenance.

The new NIPS has done much to alleviate the physical restrictions of the old system. The File Format Table or data description table has become a physical part of the file being described, reducing

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[1] Ibid., pp. 11-12.

the chances of it being lost or misplaced. Also, the physical size restriction of a logical record has been alleviated by making each individual group instance a physical record. The new NIPS is now a direct-access system using Index Sequential Access Method disc storage.[1]

Random Access Personnel Information Disseminator (RAPID)

Control Data Corporation developed RAPID as a specialized data management system for the United States Army. RAPID, as the name indicates, is an automated personnel management system that is used to maintain and retrieve data for the U. S. Army military and civilian personnel system. The system is used on the Control Data 3300 equipment.

Personnel managers in the field submit coded transactions via on-line remote terminals. The RAPID system, using COBOL programs, validates the data, and converts the accepted transactions into a common internal format through use of specialized subroutines. RAPID then takes the reformatted data and updates the data base. As a by-product of file maintenance, the system produces a list of accepted transactions and an audit trail for follow-on validation. As indicated, RAPID does not have a general-purpose maintenance capability, but utilizes a specialized system, oriented to the specialized needs of the user. The system does allow the user to specify the logical structure of the file he is using, the format of the input data, and the fields he desires to use as indicies.

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[1] Ibid., pp. 14-16.

RAPID's retrieval capability provdes a large measure of user flexibility, enabling him to:

1) use conditional expressions in describing a record or file subset,

2) call up data-reduction routines, including the ability to create a summarized matrix,

3) call up various report formats. The retrieval data can be held in a summary file until needed.

RAPID's control functions include the ability to, save jobs that users indicate will be repetitively required, call out standard jobs for processing when requested, and to monitor security access to the files.[1]

Time-Shared Data Management System (TDMS)

TDMS is being developed by the Systems Development Corporation as a general-purpose system for managing data in a time-sharing environment. Systems Development Corporation's work on the system has been sponsored in part by the Advanced Research Projects Agency of the Department of Defense. TDMS is being designed for use on the IBM System 360 Model 50 equipment.

TDMS utilizes a cathode-ray tube (CRT) display terminal, through which the user is able to describe and generate a file, and to retrieve and display data from the generated file or other accessible files. The system also has the capability of updating and maintaining files, and of producing hard copy reports.

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[1] Ibid., pp. 9-10.

Through the use of the TDMS UPDATE program the user can add, delete or change data elements on file. The MAINTAIN program allows the user to merge, extract, order or restructure files.

TDMS has two levels of retrieval capability. By activating the QUERY program, the user can generate only relatively simple outputs. More sophisticated outputs can be produced by the COMPOSE/PRODUCE programs. The COMPOSE program does just what the word implies, it composes report formats. The user describes the data to be outputted, and what the output format will look like after it has been produced as a report. There are a number of report formats available in TDMS, and each has its own name which must be given by the user. The PRODUCE program is used actually to generate any of the reports previously composed by the COMPOSE program.

The TDMS file structure uses a sophisticated system of tables to store and index the data in files. One table contains the actual data elements, another contains the names of the data elements in the files, and a third table describes the individual data elements and their logical relationships and uses a system of pointers to identify the tables where the actual data is stored.[1]

Summary

The previous discussion of some of the more prominent generalized data management systems reveals the wide variety of capabilities and applications that exist today. Although review of the success of such

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[1] Ibid., pp. 17-18.

systems indicates that they are not yet the panacea they are touted to be, their sheer numbers and continued development point out their potential importance in making management information systems available to a wider spectrum of users.

CHAPTER IV

COMMON PITFALLS ENCOUNTERED IN DEVELOPMENT AND IMPLEMENTATION OF COMPUTER-BASED MANAGEMENT INFORMATION SYSTEMS

The purposes and general characteristics of computer-based management information systems have been presented. The advantages to be gained from their proper utilization have been discussed, and the characteristics and capabilities of the more prominent generalized data management information system have been reviewed. But what of the problems involved in developing and implementing a new computer-based management information system, or converting a fragmented system to a truly integrated one? What are the pitfalls most often encountered? What are the lessons to be learned from those who have tried and failed? The following discussion delves into these important areas, presenting those problems that many individuals closely associated with management information systems feel are the more prominent problems encountered. The discussion points up the most significant problems that must be avoided, to meet with some measure of success in a new computer-based management information system.

Building the System Around the Computer Rather Than Around User Needs

The fundamental fact that management information systems must be built around the needs of the user of the information should be apparent to everyone. Unfortunately, this fact is too often overlooked or

forgotten during the pressure of systems development. In the rush to "get on the band-wagon" or to be the first to develop a computerized management information system, too many organizations have purchased the computer first and asked questions latter on how the system should be developed and what needs it should be designed to fulfill. John R. Gale points out that, "many companies rushed to obtain the new generation computer equipment, justifying the cost with vague notions of the potential services it would provide."[1] Bank of America's A. R. Zipf illustrates this point in the following quotation:

> All too often computer systems were installed without even rudimentary thought about their cost, their efficiency and, most important, their applicability to the job that needed to be done. One cannot begin to estimate what computer hysteria cost the banking industry. I doubt that anyone will question that the costs were measured in the tens of millions of dollars.[2]

Others have not made the mistake of buying the computer first and justifying the need for it later, but have built the management information system around the computer's capabilities instead of around the needs of the users. Often this situation is a result of management's mistake of allowing the computer technician to set the goals for the information system. The technician is understandably machine oriented, not user oriented. His interests will be in developing a system "geared to maximum computer operating efficiency rather than to the usefulness of its output."[3] John Diebold explains

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[1]John R. Gale, "Why Management Information Systems Fail," Financial Executive, August, 1968, p. 45.

[2]Arelene Hershman, "A Mess In MIS?" Dun's Review, January, 1968, p. 27.

[3]Gale, "Why Management Information Systems Fail," p. 45.

the danger of such an approach to management information system development as follows:

> Most technicians cannot be expected to understand the needs or the opportunities of the corporation well enough to establish goals for computer systems. Management itself must take the trouble to understand what new technologies make possible and what is necessary in order to apply them effectively and imaginatively.[1]

Perhaps Gale best sums up the importance of building the system around user needs rather than around the computer:

> An information system constructed around the users' needs is the only practical approach. To build a system around the computer configuration or the data processing technicians' ideals produces a mechanically efficient product, but it may generate information that is superfluous to management decision, control, and planning functions. While there is ample room for both user-oriented information systems and mechanically efficient data processing operations, senior management must assume the responsibility of defining system development, and technicians should design the program to achieve management's information goals.[2]

Incomplete Identification of Needs

Another common failure in computer-based management information system design is the incomplete identification of user needs. The computer can manipulate and spew out vast amounts of information in a short period of time, but often it is just that, a vast amount of information that is difficult to digest and fails to meet the needs of the user. Arlene Hershman describes the problem as follows: "Overdetailed records are spewed forth by 600-line-a-minute print-out

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[1]John Diebold, "Bad Decisions On Computer Use," Harvard Business Review, January/February, 1969, p. 17.

[2]Gale, "Why Management Information Systems Fail," pp. 45-46.

machines, inundating management with all the information it does not need to make a decision."[1] Vice President Robert Owen of the First National City Bank of New York illustrates the situation another way, "The chief executive knows that the problems of the business are hidden somewhere in that pile of print, but he cannot find them."[2]

Managers insist that the problem lies in the fact that the computer technicians don't give them the information they need. On the other hand, the computer technician puts the blame on the managers, insisting that they do not know what information they need. The answer to the dilemma appears to be somewhere between the two extremes. The computer technician or systems design expert is not attuned enough to the management function to be aware of the total ingredients in the decision-making environment. On the other hand, management often has not given enough thought to its information requirements, is not acutely aware of the limitations of the computer, and finally, often does not possess enough knowledge of the management science capabilities (e.g., simulation, queing theory, etc.) for improving the quality and scope of information.[3]

In order to avoid the problem of incomplete identification of user needs, the more successful organizations suggest that thorough need identification is a joint management/systems design responsibility. Some firms have teams consisting of management and systems design representatives working out the problem together. Others have "the systems designers prepare their version of management information

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[1]Hershman, "A Mess In MIS?" p. 27.

[2]Ibid.

[3]Couger, "Seven Inhibitors To A Successful Management Information System," p. 16.

specifications, then meet with management to consider what items might have been omitted."[1]

Perhaps the best method is to start with the conduct of a thorough systems survey. A properly conducted survey can,

> ...spell out what data the company has, what data is needed, and what is the volume of data to be handled by the system. Further, it will indicate when information is generated, when it is needed, who causes decisions, who creates data, who needs it, and how the computer can be used... .[2]

The systems survey should include a user study to analyze thoroughly the purpose and methodology of the operation, and to identify the anticipated results the user is seeking. The "critical incidence" approach described by John Norton is perhaps the most direct and useful method of conducting a user survey. With this system,

> The user's needs are determined by asking him to:
> - List all decisions he has made over a period of time.
> - Specify what information he needed to support these decisions.
> - Disclose where he obtained the required information and how long it took to obtain in the desired form.
> - Describe the faults he found in the information he recieved or explain how valid he thought it was and why.[3]

Complete identification of user needs requires the team effort of management and systems designers. Application of some of the above methods have proven to be successful in avoiding this management information system pitfall.

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[1] Ibid.

[2] Anton K. Dekom, "Success In Computer Conversions," Financial Executive, October, 1968, p. 42.

[3] John H. Norton, "Information Systems: Some Basic Considerations," Management Review, September, 1969, p. 22.

Incorrect Identification of Principal Users And Priorities

The problems of correct identification of the principal users, and of appropriate assignment of priorities, go hand in hand. Frequently in the development of computer-based management information systems, the priority assigned a project or module will be based on the power of the position held by the individual who will use the information, rather than on the importance of the project to the firm. John Gale gives an example of this situation, wherein the president's requirement for a monthly income statement was given priority over the sales vice president's request for sales and product profitability information needed for making key marketing strategy decisions. In such a situation the decisions made by the sales vice president from his information could very likely be far more important to the firm and have a greater effect on profits than the president's decisions based on the income statement.[1] In the above situation, the sales vice president should have been identified as the principal user of information, and his requirements given priority.

It is admittedly not always easy to identify correctly the principal users of management information. Gale points out that,

> While prime users of management information systems vary from company to company, they are generally those managers who frequently make critical decisions based on complex information chains.[2]

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[1] Gale, "Why Management Information Systems Fail," p. 46.

[2] Ibid.

Daniel Couger also discusses the importance of identifying the principal user, and of assigning the correct project priority. He gives some guidance on which systems should be identified as the principal user systems and given the higher priority. He says,

> Unfortunately, priority designations among systems are often inconsistent with the criticality of the system to the firm's operations. Too frequently accounting systems are given higher priority than systems which provide greater return on investment, such as an inventory system, or than systems which initiate company actions such as the market forecasting system. In most cases, a recording system, such as accounting, deserves low priority compared to an initiating system, which provides the firm with higher quality forecasts and greater reactive capability in a highly competitive market.[1]

In addition to the obvious benefits of putting the proper emphasis in the area where it will do the most good, assigning proper priorities using the "principal user criteria" has an additional benefit. It will reduce the incidence of crisis-type requests from "the overly aggressive manager who pushes for specialized applications, on a 'top priority' basis, which serve only his limited needs."[2] In other words, a priority system, approved by top management, will help to reduce the frequency of unwarranted "crash programs" that are pressed ahead of more vital requirements.

Failure to Communicate

There are two areas of concern in the "failure to communicate" problem. The first area involves the inability of the user and systems

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[1] Couger, "Seven Inhibitors To A Successful Managment Information System," p. 19.

[2] Michael R. Moore, "Pitfalls In Planning An ADP Installation," Management Services, September/October, 1968, p. 6.

analysts to communicate. The second area involves top management's inability to communicate to company personnel the importance of the successful implementation of the management information system.

The first area is considered by many to be the most significant pitfall encountered in the development and implementation of a computer-based management information system. The communication problem between the user and systems analyst is pointedly expressed by Michael R. Moore. He states that,

> A user presumably knows what he wants, but he typically cannot communicate with the machines and has great difficulty in explaining his need to the man who can make the machines talk. The EDP analyst-programer presumably can make the machine sing if he wants to, but he typically has a problem scoring the music because he can't figure out the user's composition.[1]

The first step toward solving this problem is for these two groups "to express concepts in the other man's language."[2] They must make every attempt to understand each other's jargon before they can hope to communicate. In addition, as discussed in the section on user needs, the systems analyst must orient his thinking toward the information needs of the user. The analyst must become more aware of the management function, and better understand the decision makers' information needs. On the other hand, the management user needs to analyze and identify his information needs thoroughly, and to become more aware of the computer's limitations. Only when both the systems analysts and managers better understand each other's problems will they be able to communicate effectively.

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[1] Moore, "Pitfalls In Planning An ADP Installation," p. 13.

[2] Ibid.

In the second area involving communication of the importance of the management information system project to the company personnel, it is important to remember that resistance to change and lack of a feeling of participation can be significant roadblocks to the success of the project. "Communicating the purpose of the system's effort is the most effective means of minimizing these problems."[1] As Martino so aptly puts it,

> Upper management knows that these benefits will be achieved, or it would not proceed with an information system. Tell the employees. They would like to know, too. It is obvious that their support is needed to bring these benefits to the company.
>
> Without such employee support, the MIS installation and the new system will be in for trouble. Therefore, it is important to start the educational program when the first study of the system begins.[2]

The development of a new management information system can generate fear, uncertainty and resentment. The new system will most likely result in organizational changes, new procedures, and reduction of routine clerical jobs. Such a situation will naturally make employees apprehensive about their future,and can very likely generate resistance to the new management information system. This resistance will not necessarily be confined to lower level personnel. Higher level managerial functions may well be consolidated with others, resulting in loss of prestige or even loss of jobs. The effective implementation of a management information system requires that employee fears and resentment be allayed and combatted at the early stages of the system's development. The importance of the system to

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[1]Gale, "Why Management Information Systems Fail," p. 46.

[2]Martino, MIS-Management Information Systems, pp. 80-81.

the firm, and therefore to the well-being of every employee, must be effectively communicated in order to avoid the pitfall of having the system sabotaged from within.

Lack of Top Management Involvement And Support

Few experts in the management information field will argue with the fact that top level management attention is essential to the successful implementation of a computer-based management information system. Warren McFarlan states, in a recent article in the Harvard Business Review that, "CBIS (Computer Based Information Systems) planning stands a better chance of getting off the ground if the chief executive backs it personally."[1] This same view is expressed by Anton K. Dekom in a Financial Executive article in which he comments on a McKinsey & Company survey which reviewed the keys to successful systems and computer installations. He states that,

> Above all, there must be managerial attention. A survey made by McKinsey & Company states that, "No company achieved above-average results without the active participation of top management."[2]

Too often, however, top management feels that its support is all that is required, and it delegates the responsibility for the development of the management information system to subordinates or the systems design technicians. Many feel that support alone is not enough. They feel that too much is at stake to send in the "second team." They also point out that the experience and knowledge of top management,

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[1] F. Warren McFarlan, "Problems In Planning The Information System," Harvard Business Review, March-April, 1971, p. 84.

[2] Dekom, "Success In Computer Conversion," p. 45.

and the fact that they are probably the principal future users of the management information system's output, require that they involve themselves deeply in the planning and development of the new system. This viewpoint is clearly expressed by Michael R. Moore in the following quotation from his article in Management Services:

> It is difficult to find much sympathy for the unhappy management which doesn't get seriously interested in defining its objectives until the EDP project has almost reached operational status - only then to discover that the system isn't designed to produce the information that management really needs or wants. The practical lesson here is that the user must remove himself from the conceptual level of definition and get into the specific details at as early a point as possible in the systems definition and design effort. If he does not, the implementation cycle will become a merry-go-round for everyone concerned.[1]

The concept of deep managerial involvement is also expressed by William M. Zani in the following quotation from his article "Blueprint for MIS":

> Most experts agree that top-management support and participation are necessary for effective system design, but they generally state that this support is necessary only for budget control and control of the data-processing group.
>
> The framework I am presenting, however, implies a much more extensive participation than this. It assumes that top management itself must start the design process - i.e., must first delineate the organizations strategy, structure, and decision-making processes for the specialists in the design group, and then make sure that the specialist designers integrate these elements fully into the basic system design.[2]

The degree to which top management devotes itself to the design and development of a computer-based management information

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[1]Moore, "Pitfalls In Planning An ADP Installation," p. 5.

[2]William M. Zani, "Blueprint for MIS," Harvard Business Review, November-December, 1970, pp. 96-98.

system can often determine the degree of success the system will enjoy. Lack of proper involvement and support on the part of top management can doom the system to failure.

Underestimating System Complexity

The designing and implementation of a computer-based management information system are extremely complex and difficult undertakings. It is not uncommon for a new system to take from three to five years to design and implement. The danger in underestimating the system's complexity is that information users expect faster results. They become impatient for outputs, and disillusioned because the dynamic results they envisioned are not forthcoming. Another danger in underestimating the system's complexity is that it can often result in inadequate project staffing.

Of course, the most effective means of combating the pitfall of impatience are to develop a comprehensive statement of the new management information systems capabilities along with a time table showing the scheduled development stages expected. Wide dissemination of this information early in the project can go a long way toward eliminating the problems associated with over-eagerness for output products.[1]

The problems of disillusionment and impatience for tangible results can also be avoided by developing a modular system wherein some programs can be implemented in the early stages of development. In this way, some less complicated programs can be instituted early in order to show some tangible results, and to help maintain interest and

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[1] Gale, "Why Management Information Systems Fail," p. 47.

support for the new system. These modules can and should be capable of being integrated into the total system. Krauss supports this point by saying, "The key to success is to have a series of planned implementation phases that have payoffs at shorter time intervals."[1]

Inadequate project staffing, as a result of underestimating the system's complexity, could mean either not assigning enough people to the job or assigning people without the proper technical capabilities. The utilization of experienced management consulting firms and the assistance of the "software" development staff of the selected "hardware" manufacturer can aid considerably in determining the manpower requirements both in terms of numbers and capabilities. Their assistance can be of particular help during the definition and design stages.[2]

Miscellaneous Problems

There are many more pitfalls encountered, each with varying degrees of importance and frequency of occurrence. Space and time do not permit a complete discussion of them all; but a brief comment on each will be made to indicate the existence of these potential dangers.

Power politics. The development of a management information system frequently results in the realignment of the organization's power structure. Such realignment can generate political in-fighting and power drives that can prove to be very disruptive to the organization, and hinder system progress. Early identification of potential struggles can do much to help top management solve these problems before they create difficulties.[3]

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[1]Krauss, Computer-Based Management Information System, p. 32.

[2]Gale, "Why Management Information Systems Fail," p. 47.

[3]Gale, "Why Management Information Systems Fail," p. 47.

Inadequate documentation. Complete documentation is essential to a management information system. It shows what inputs are required and their sources, as well as the outputs generated and the output format design. Documentation also contains the flow diagrams that show how the system works, the detailed programs that have been developed, and the technical procedures that must be followed in computer operations. Documentation is essential to communication between members of the systems development team, as well as to those who must operate the system. It is also vital to managment because it aids them in understanding how the system works. It is vital to the technicians because it shows them what has been done so that they can then determine how to change the system. Inadequate or incomplete documentation may create insurmountable communication problems and render the system useless if its inner workings cannot be ascertained.[1]

Lack of post-implementation evaluation. Periodic review and evaluation is essential to determine if the system is performing in the manner in which it was designed. Many organizations do not put proper emphasis on this phase of system development, or incorrectly assume that it is a technician's responsibility. Moore illustrates the importance of user involvement in the testing of the system when he says, "...it is the user who is in the best position to interpret the adequacy and the results of tests."[2] Failure to evaluate the

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[1] Moore, "Pitfalls In Planning An EDP Installation," pp. 14-15.

[2] Ibid.

effectiveness of the management information system and to take the necessary steps to improve it can be a costly error just when the system is close to delivering results.

Failure to integrate external data. Many organizations develop systems to collect and process internal information but fail to include vital external data. An organization is always affected to some degree by the environment in which it operates. A management information system should be able to accept mechanized data containing changes and trends that affect its operations. External information such as census data and economic, marketing and trade indicators should be incorporated into the management information system to, "... improve market forecasting and achieve faster response to a changing market environment."[1]

Summary

There are many pitfalls to be avoided in the development and implementation of a management information system. It is doubtful that the above discussion has covered all of them, but this list is considered representative of the many problems that can occur. The recognition and acknowledgement of the existence of these frequently occurring problems are the first steps in preventing them from happening. No organization can avoid all of them, and indeed if it did, it would probably encounter others heretofore unknown. Careful planning and coordination, however, should minimize the effects of any potential pitfall.

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[1]Couger, "Seven Inhibitors To A Successful Management Information System," p. 18.

CHAPTER V

PREVALENT VIEWS ON THE EFFICIENCY AND COST EFFECTIVENESS OF COMPUTER-BASED MANAGEMENT INFORMATION SYSTEMS

The many advantages to be obtained through utilization of a computer-based management information system have been presented. The problems and pitfalls that are often encountered have also been discussed. The question that remains is, are management information systems worth the effort? Do the benefits gained through their application justify the prodigious amounts of money, manpower and materials expended in their development and operation? There are many facets to this controversial question, and great volumes of opinions as well. Perhaps the best way to respond to this vital question is to present the many cogent viewpoints of prominent individuals in the data-processing and management field. Their experiences and opinions acquired through developing and operating computer-based management information systems make them eminently qualified to respond to this question. Their views can best present the opposing sides to this question and shed light on what the answer may be.

The views of those individuals that question the value to be gained from computer-based management information systems are presented first; followed by the advocates who insist that such systems are not only worth their cost, but are vital to the survival of management in today's information packed world.

Views Questioning The Value to be Gained From Management Information Systems

There is the opinion held by some individuals that management information systems are not all they have been purported to be; that they have not developed to the stages that the literature would have one believe. This view is expressed by Russel E. Ackoff in an article in Management Science. In his view:

> Contrary to the impression produced by the growing literature, few computerized management information systems have been put into operation. Of those I've seen that have been implemented, most have not matched expectations and some have been outright failures. I believe that these near-and far-misses could have been avoided if certain false (and usually implicit) assumptions on which many such systems have been erected had not been made.[1]

John R. Gale in a Financial Executive article also questions whether management information systems are really all they are supposed to be. He believes that too few have reached fully operational stages to be able to evaluate them properly. In his article he states:

> In recent years, professional management publications have been inundated with articles on management information systems. Many of the dissertations are enthusiastic about the systems, but they give no indication of the difficulties encountered during the design and implementation phases. Further, it is doubtful that many of the systems described in these articles are fully operational. Modern management information systems require complex long-term efforts, and study indicates that new companies have as yet completely implemented the modern systems we read about in the magazines. Those that have developed successful information systems have done so at great expense and with great effort.[2]

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[1] Russel E. Ackoff, "Management Misinformation Systems," Management Science, December, 1967, p. 147.

[2] Gale, "Why Management Information Systems Fail," p. 45.

Another group of individuals question the value of a computer-based management information system because, in their view, the existing systems do little more than generate great masses of reports too voluminous to be of value, or ones that do not provide the user with the needed information. An executive of the Norge division of Borg Warner expresses his discontent with the content of a sales forecasting report this way:

> In computerized sales forecasting, the computer is supposed to be able to project forward what has happened before to help the company decide what products within a line it will produce.
>
> But, a forecast based on computers-at least at our degree of sophistication-isn't very helpful. Unfortunately, there is no way to design a computer that can call the turn. As long as sales are going up, it says so; as long as sales are going down, it says so. But to get over the hump either way becomes an intuitive problem. The sales forecast may be a help for long-range planning, but for the first quarter of next year it leaves a lot to be desired.[1]

Arlene Hershman provides further illustrations of organizations that have found the management information system output to be of little value. In her article, "A Mess in MIS?" she states:

> ... Radio Corp. of America with the latest in sophisticated equipment at its disposal, has found that sales forecasting will not reveal any brief downturn ahead in sales of color-TV sets. Likewise, brokers and investors have been forced to the realization that "forecasting by computer" does not mean a thing in the day-to-day area of buy or sell decisions.[2]

Volume alone can render the information provided from the management information system useless. Vice President Robert Owen

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[1] Hershman, "A Mess In MIS?" pp. 26-27.

[2] Ibid., p. 27.

of the First National City Bank of New York points out the failure of his bank's management information system as follows: "The chief executive knows that the problems of the business are hidden somewhere in that pile of print, but he cannot find them."[1] The head of a Columbia Broadcasting System department expresses it another way:

> Before the company started computerizing my department, it took me a month to get a progress report, which was too long a time for it to do me any good in catching trouble spots. Now I get a report every other day - but it takes me two months to read it.[2]

An issue of U. S. News and World Report painted a facetious picture of what can happen when reports generated by the computer are poorly planned and indiscriminately produced. The author of that article expressed the problem rather humorously as follows:

> There was a sales executive crushed under four tons of sales reports. There was a production engineer being strangled by punch tape. There was the president of the company, his office piled from floor to ceiling with reports, figures, indexes, computations, and permutations ... his office stuffed, and he, emaciated and bug-eyed, reading his way through reports at a rate slower than reports were being produced.[3]

Perhaps Arlene Hershman made the most damning indictment concerning the usefulness of management information systems' output when she said:

> "Every baby is born ugly," says the old Spanish proverb. But even after allowance has been made for the shortcomings of infancy, responsible critic's point out, MIS has failed in its principal purpose:

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[1] Ibid.

[2] Ibid.

[3] Robert L. McFarland, "Electronic Power Grab," Business Automation, February, 1965, p. 31.

> to produce the information that management needs to run the business. Here, the record of MIS mismanagement is writ large.[1]

Other critics of the computer-based management information system express the view that too often the systems developed have been a waste of time, money and energy simply because they have been hastily conceived and poorly planned by management preoccupied with being modern. The executive vice president of Bank of America, Mr. A. R. Zipf, articulated this situation to a seminar at Harvard as follows:

> We have seen over the past twelve years some incredible blunders. Twinkling lights, spinning tapes and pastel cabinets seem to have a mesmerizing effect on some managers. In a pell-mell rush to be among the first to play with a new toy, enormous sums have been wasted.[2]

He goes on to say:

> All too often, computer systems were installed without even rudimentary thought about their cost, their efficiency and, most important, their applicability to the job that needed to be done. One cannot begin to estimate what computer hysteria cost the banking industry. I doubt that anyone will question that the costs were measured in the tens of millions of dollars.[3]

John Diebold describes the blunders of management in installing systems using the wrong criteria, in an article in Harvard Business Review:

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[1] Hershman, "A Mess In MIS?" p. 27.

[2] Ibid., p. 26.

[3] Ibid., p. 27.

> Nowhere is this lack of sophistication more apparent than in the way in which computers are applied in American industry today. Most companies carefully weigh the decision, consider the alternatives, compare the relative costs, and then reach a conclusion - on the basis of the wrong criteria entirely.
>
> The problem is not lack of technical knowledge on the part of the experts. Rather, it is the failure on the part of top management to ask the right questions. It is the failure in particular to seek quantitative measurement of the very real benefits of automatic data processing (ADP) to a business. I do not mean cost displacement but rather increased management capacity to control and plan. Such benefits are not being considered in a serious and meaningful way; yet they are today the principal reason for computer use and for moving computers out of accounting and into operational use.[1]

In an article in Datamation, Howard Bromberg expresses his concern that management is losing control of the organization because of its efforts to be modern through use of computer-based systems.

> Today's businesses are categorized by their managements as being "modern," due primarily to their acquisition and utilization of computing equipment. On the contrary, the proliferation of specialized technical knowledge has turned the modern corporation into a bewildering complex collection of special departments, computer centers, training centers, programming groups, systems and procedures departments, and the like. These units often occupy a semi-autonomous status within the corporation, enjoying their own budgets, governed by their own brand of technical officer, adopting their own standards, and largely oriented toward movements and constituencies outside the corporation. Thus, the modern computer-based corporation becomes

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[1] Diebold, "Bad Decisions On Computer Use," p. 15.

> a holding company with only nominal control over the agencies which bear its name.
>
> The result of this corporate condition is a phenomenon unrecorded in this country since the days of the snake-medicine peddlers. Mainly, the use of the computer has been accepted as the technoligical placebo by corporate management. The fact that computer costs were, in the past decades, unmeasurable and to a large extent unaccountable - as well as the strong possibility that computer costs were considerably higher than manual methods - did little to dissolve the corporate computer romance.[1]

He goes on to say:

> .... People believed that, once a computer culture was advanced, they must scramble to emulate it in order to avoid the stigma of inferiority. Hence, a mistake perpetrated by a leader in the industry would be promulgated forever by its members. Perhaps the affability of our technical participants has been encouraged by the fact that they operate within an environment that supplies them with a generous margin so that concessions are always possible and mistakes always camouflageable.[2]

Many concede that the computer-based management information systems have indeed provided valuable information but they point out that the benefits gained do not justify the heavy costs. Joseph Poindexter expresses this view in an article in Dun's Review, wherein he said:

> The number is $20 billion, the whopping investment that U. S. industry has made in computer technology over the past fifteen years. The fact is that most chief executives now realize they have not been getting anywhere near their money's worth from that investment.

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[1] Bromberg, "Revolution - 1970," p. 32.

[2] Ibid., p. 32.

> Even today, the computer in most companies is still being used primarily as an adjunct to other company functions - accounting, personnel, and so forth. The result is fragmented EDP operations that cost too much and yield too little. Particularly with the advent of the complex and expensive management information systems, replete with all the paraphernalia necessary for instantaneous decision-making, costs and promises have far outdistanced benefits and delivery. Few managements understand the systems they have ordered up, and even the technicians seem to have underestimated the full implications of their undertakings.[1]

Richard Kaimann reveals that most firms have been unable to realize a return on their investment in a computer-based system large enough to cover their development costs. In a Journal of Systems Management article he says:

> Management has long been cognizant that the discipline frequently referred to as data processing, integrated information systems, and other aliases has not been totally successful in the climate of the business enterprise.
>
> A study performed by a noted consulting firm in 1964 pointed this fact out rather explicitly. That survey indicated that two thirds of the surveyed companies "... acknowledged that they had not recovered their start-up costs and that their company installations were well below a self-sustaining basis."[2]

In an apparent reference to the same study, Allan Harvey, president of the Dasol Corporation, reinforces this point. He said, "It is no accident, for example, that a recent study by McKinsey & Company shows that two out of three companies sampled in the study have failed to

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[1] Joseph Poindexter, "The Information Specialist: From Data To Dollars," Dun's Review, June, 1969, p. 26.

[2] Richard A. Kaimann, "Effective Program Development: An Underdeveloped Art," Journal of Systems Management, November-December, 1968, p. 46.

turn a profit on their computer after four years."[1]

Arlene Hershman feels that management is fooling itself with studies that show the potential profits that can be earned by a management information system. She expresses the following view:

> But can a company determine that profits will be better as a result of MIS? The answer seems to be that it cannot. All of management's feasibility studies to prove potential profits, say the skeptics, only prove how badly it wants to use MIS.[2]

Perhaps Hershman best sums up the feelings of those who question the value of management information systems when she says in her article, "A Mess In MIS?":

> ... What this phenomenon points up, of course, is top management's growing reliance on the computer to help in decision-making and its willingness to invest millions of dollars in equipment and manpower to put together a management information system. What management ultimately expects is a total system that will instantaneously provide all managers - at every level from plant foreman to chairman of the board - with every fact they need to know in order to make a decision.
>
> But is this possible? And do the results of MIS justify all the money and time that have been poured into it? Probably not. Despite some reported successes, management's headlong commitment to MIS does not seem to have been worth the effort - at least so far.[3]

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[1]Allan Harvey, "Systems Can Too Be Practical," Business Horizons, Summer, 1964, p. 69.

[2]Hershman, "A Mess In MIS?" p. 85.

[3]Ibid., p. 26.

Views Supporting The Value And Cost Effectiveness of Management Information Systems

The impact and importance of management information systems is supported by many experts in the field. In their article, "How Intelligent Is Your 'MIS?'" Robert L. Johnson of the Arcata National Corporation and Irwin H. Derman of the Stanford Research Institute state:

> Information technology, associating the power of the computer and advanced techniques for management planning and control, has significantly improved the practice of management in the past fifteen years.[1]

Leonard Krauss in his book Computer-Based Management Information Systems indicates his feelings on the impact of management information systems. He expresses the view that:

> The advanced capabilities that MIS seem to possess has captivated the imagination of many students of management. Some see vast change resulting from MIS, while others argue that less dramatic reorientation is more realistic. Few believe that no changes will result with the advent of MIS.
>
> In a great many companies, the mighty sums of money and other resources being consumed in MIS work are a solid indication of their management's belief in the promises of MIS. The emphasis on putting MIS to work is underscored by such statements as this: "The day may not be far distant when those who analyze annual business failures can add another category to their list of causes - failure to exploit the computer.[2]

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[1]Robert I. Johnson and Irwin H. Derman, "How Intelligent Is Your MIS?" Business Horizons, February, 1970, p. 42.

[2]Krauss, Computer-Based Management Information Systems, p. 277.

In response to those that insist that the cost of computer-based management information systems are prohibitive and that the results do not justify their expenditure, Terrance Hanold, President of The Pillsbury Company points out in his article "A President's View of MIS," that it is hard to put a dollar figure on the value of information. But, that in evaluating whether or not a management information system is worth the cost, the value of information must be considered. In his article, he states:

> The test of the new system is not data cost but data value. The proof of data value is no longer found in the reduction of administrative personnel, but in the profitable utilization of highly qualified middle management people. ... The design and development of this new data system must serve value creation first and cost reduction later.[1]

Johnson and Derman also point out that in evaluating the worth of a computer-based management information system, the costs of acquiring information manually (or on an ad hoc basis) must be considered, as well as the cost of not having that information when needed. In their words:

> In short, an information system designed for the orderly and systematic procurement, transfer, storage, and conversion of data will reduce time, effort, and cost, and increase the utility of information. The cost of developing and implementing such a system must be weighed against the cost of searching for, finding, and handling data on an ad hoc basis or, worse, the consequences of making a decision without pertinent information.[2]

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[1] Ibid., p. 12.

[2] Johnson and Derman, "How Intelligent Is Your MIS?" p. 37.

Many prominent individuals with experience and knowledge in the computer-based management information system field indicate that the greatest impact of such systems has not yet been felt. They feel that the future will demonstrate the greatest potential of management information systems. Robert E. McDonald, president of UNIVAC declares, "... By the time we reach the 1973-75 era, the manager who does not use MIS techniques will not be able to effectively compete in the marketplace."[1] Walter E. Kleinschrod predicts in an article in Administrative Management that:

> ... management will, by the middle of the Seventies, have at its disposal the electronic resources to plan, control, analyze and optimize for surer middle management decisions. By then, computer systems will no longer be merely tools for accomplishing functions; they will be tools for tactical planning, on their way to becoming by the mid-Eighties "the heart of the structure."[2]

Earl C. Joseph states in an article in Financial Executive that, "By the mid-1970's, unless managers use management information systems in their daily conduct of business, they will find themselves incapable of performing management tasks."[3] Later in the article he goes on to say:

> Those of us working in the computerized management information system field are predicting that such systems certainly will evolve and come into mass use by executives. We further predict that those managers, companies, politicians,

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[1] Walter S. Kleinschrod, "Computers And Middle Management: Where Are We Now?" Administrative Management, May, 1969, p. 16.

[2] Ibid.

[3] Joseph, "The Coming Age Of Management Information Systems," p. 45.

> and governments who do not use such systems by 1975 to 1980 will simply not be able to compete in a society which does.[1]

Murdick and Ross in their book Information Systems For Modern Management also share the view that management information systems are a vital ingredient for future success. They put it this way:

> Many forward-thinking leaders deem computer-based information systems a prerequisite for survival in the forthcoming decades. As the president of Pillsbury stated, "There is one other condition to success in 1975 - that is an information - oriented management system."[2]

This emphasis on the future success of management information systems suggests that the critics of these systems are not completely wrong. Most advocates will concede that problems exist in management information system development, and that failures may outnumber the successes. But, they feel the problems can be overcome and that the management information system will indeed be the vital tool required for future success. John R. Gale in his article, "Why Management Information Systems Fail" puts it this way:

> All difficulties covered in this article can be overcome if management makes available adequate resources to plan, organize, and implement the project properly. Many successful management information systems using modern data gathering and computing techniques are operating successfully so top management should not be discouraged from making the effort. No management can afford to be satisfied with its past

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[1] Ibid., p. 52.

[2] Murdick and Ross, Information Systems, p. 550.

> information system methods; it can be sure that sooner or later its competition will become aware of the aids to management decisions available through a well-developed management information system using modern processing and data-reporting techniques.[1]

Arlene Hershman, after listing the many failures of management information systems, also concedes that they can be valuable and worth the effort. In her article, "A Mess In MIS?" she concludes that:

> In the opinion of the experts, however, MIS can work. What is needed above all else, they insist, is a true understanding by top management of what MIS really is and what it can do. Sums up Bank of America's Zipf: "I am hopeful that if business generally will face up to the facts and use computer technology to meet needs rather than to employ hardware, to produce profits rather than status, to evolve meaningful and economically sound information systems rather than glamorous and wasteful projects, the day of fully integrated MIS may dawn with man still in command."[2]

Perhaps R. L. Martino in his book MIS-Management Information Systems best sums up the importance of management information systems for the future. He says:

> As more and more companies develop information systems, it becomes increasingly necessary to install one. The alternative is to lag behind the competition. Improved market forecasts, sensible inventory levels, fast service, and low overhead will allow companies with Management Information Systems to increase their share of the market at the

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[1] Gale, "Why Management Information Systems Fail," p. 47.

[2] Hershman, "A Mess In MIS?" p. 87.

expense of their less prepared competitors. Thus, developing an information system is not "jumping on the bandwagon"; it becomes a necessity for continued success, if not survival itself.[1]

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[1]Martino, MIS-Management Information Systems, preface.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

Chapter I provided background information concerning the intent and purpose of this thesis. Presented therein were a few excerpts illustrating the two sides to the controversial question of whether or not the achievements of computer-based management information systems justify the prodigious amounts of money, manpower and materials expended in their development. Several quotations were given demonstrating the strong feelings of advocates of management information systems. Those quoted indicated their belief that the management information system would soon become the indispensible tool of management and that those who did not employ it would soon be unable to survive in this information packed world. Quotations presenting the opposing view illustrated the beliefs of others, that the many failures and short-falls experienced by organizations that had implemented management information systems indicated that the systems were not worth their associated costs.

Chapter I went on to describe that it was the intent of this thesis to identify the benefits to be gained from computer-based management information systems, as well as to identify the pitfalls and problems encountered in their development. Chapter I also described the intention to review the characteristics and capabilities of the more prominent generalized data management systems and to present cogent views of prominent individuals in the data processing and management field concerning the value of management information systems.

In Chapter II, several definitions of a computer-based management information system were discussed. Krauss' definition, "the integration of the computer with management decision-making process"[1] was presented as perhaps the most concise. A discussion of the purpose of the computer-based management information system was also presented. In the course of this discussion, information was described as differing from data in that information was data that had been evaluated as applicable to a particular individual and situation. The purpose of a computer-based management information system was determined to be to, "... provide management at all levels with relevant but no other data, in the most easily assimilated form, at the precise moment when a policy decision has to be taken."[2]

Chapter II also identified the general characteristics of an integrated, computer-based management information system. Management information systems are described as the nerve center of an organization and the means by which the money, manpower, materials, machines and facilities are melded together so that they can function as an integrated whole. The elements that make up the computer-based management information system, and that are used to perform the integrative role, are identified as procedures, equipment, information and people. Procedures are the detailed and formal instructions for operating the system. The equipment is, of course, the modern third generation computer with its attendant peripheral devices and software. Information is the cornerstone, the single most important element of any management

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[1]Krauss, Computer-Based Management Information Systems, p. 1.

[2]Musk, "One Man's Meat: Part 2-Not Let's Pretend," p. 213.

information system. People are the least predictable, the least subject to control and, of course, also one of the most important elements of the management information system. Ultimately, the elements of the computer-based management information system are arranged into a design that will produce the desired objective. Following established procedures, the inputs of planning information and other data are transformed by the management information system computer into outputs that are designed to produce information for planning and control. Control is achieved by developing sensors that measure the outputs of the system against predetermined standards of performance and that then generate management reports that track the output status against the standard. If results do not measure up to the standard, information is fed to people in the planning analysis and control group who make the required management decisions to adjust the system based upon decision rules or data contained in the data bank.

Finally, Chapter II outlined the many advantages to be reached from proper utilization of computer-based management information systems. Timeliness is identified as perhaps the most important advantage. The time-saving attributes of computerized routines allow more up-to-date information to be incorporated into research and evaluation as well as more time for management to study the situation thus making it possible to render faster and more informed decisions. More comprehensive analysis is another advantage to be gained from application of a computer-based management information system. Speed in processing allows more data to be examined, and more parameters to be included in the analysis.

Simulation, another benefit of the computer-based management information system, allows the manager to ask "what if..." questions and then to test the outcome in simulated realistic circumstances. The manager thus can see in advance the results that would probably occur if he applied a given solution to the problem.

Management control and evaluation are also enhanced because the manager can more readily compare the work of one division with another or against predetermined plans or goals. The management information system also enhances control and evaluation by allowing the manager to probe more deeply, and to evaluate more realistically.

An integrated management information system (i.e., one utilizing a common information data base) provides the additional benefits of eliminating duplication of effort in maintaining the same data on separate files and of improving accuracy and reliability by operating all systems from a common base.

The advent of real-time management information systems (i.e., those that have the ability to record events and react to them as they occur) ushers in many additional benefits. Real-time provides instantaneous information, further improving the managers ability to react to critical situations. Real-time also provides improved man-machine interaction in problem solving and eliminates the requirements for voluminous hard-copy reports.

Chapter III discussed the characteristics and capabilities of prominent generalized data management systems. The problems associated with developing customized management information systems around the

unique operational requirements of the user organization were presented along with the advantages attainable from use of generalized systems.

The traditional method of developing customized systems generates high implementation and maintenance costs. Another associated problem is that such systems are invariably inflexible, and therefore unable to adapt to changing needs and developments, rendering them obsolete in a short period of time.

The generalized data management system is based on the premise that certain common data processing functions, such as file creation, file updating, retrieval, logic and arithmetic processing, sorting, merging and report generation, exist in all management information systems. Generalized data management systems have developed standard programs in these common function areas that are broad and flexible enough to cope with many diverse types of information and that can be controlled by parameters submitted by the user. The generalized data management system can therefore be brought into an organization and used to build and manipulate data files at a fraction of the time and cost expended in creating the customized system. In addition, they provide more direct interface between the user and the computer, eliminating the costly requirement for the middleman programmer. Finally, the flexible nature of the generalized data management system allows them to keep pace better with changing requirements for files, information and reports.

Chapter III then presented the general characteristics and capabilities of the more prominent generalized data management systems,

such as COGENT III, DM-1, GIS, MARK IV and others. This presentation revealed the wide variety of capabilities and applications that exist today. It also pointed out that although generalized data management systems may not have reached their full capability as yet, their sheer numbers and continued development point out their potential importance in making management information systems available to a wider spectrum of users.

The common pitfalls and problems encountered in developing and implementing computer-based management information systems were discussed in Chapter IV. One common problem is that many systems are built around the capabilities of the computer, rather than around the needs of the user. This is generally caused by the fact that computer-oriented technicians rather than management are setting the goals for the system.

Another frequently experienced problem is incomplete identification of user needs. Too often, a hastily developed management information system will be implemented that fails to meet a major portion of information needs. A thorough systems survey that includes a user-information-needs-study will help to avoid this problem. The systems survey will help to identify what data is needed, who creates it, who needs it, when it is needed, and how the computer can be used to aid in the process. The "critical incidence" method of studying user needs requires the user to identify the decisions he has to make, what information he needs, where he obtained it, how long it took to acquire, and what faults, if any, he found with the information.

Complete identification of user needs requires the team effort of management and systems design personnel.

Poorly designed management information systems also fail to identify correctly the principal users of information, and consequently fail to assign proper priorities to the development and scheduling of reports. Frequently, a system will assign the priority for a project based on the power of the position held by the individual who will use the information rather than on the importance of the project to the organization. The principal user should be the individual who must make the critical decisions; and the higher priorities should be assigned to his requirements.

Communications is often a problem, in that the manager user of the system is unable to identify adequately and explain his requirements to the systems design expert. The systems design expert, in turn, lacks the understanding and appreciation of the manager's function. Another communication problem is often encountered when top management fails to get the full support of the organization in the new endeavor. Management often fails to allay fears and reduce resistance by communicating to the employees the intent, purpose and importance of the new management information system.

Lack of proper involvement and support on the part of top management can doom the management information system to failure. Top management must not only give full support to the development of the system, it must get deeply involved in the design effort. As the system develops, top management must also ensure that the desired features are, in fact, incorporated into and properly function within the new system's framework.

Underestimating the system complexity can lead to impatience and disillusionment. Information users that do not understand that it often takes from three to five years to develop a management information system become impatient for outputs, and become disillusioned because the dynamic results they envisioned are not forthcoming. A comprehensive statement of the new system's capabilities and a table showing the scheduled development stages can aid in eliminating this pitfall.

Many additional pitfalls, generally of lesser importance, can be encountered. Internal power politics can hinder system progress. Inadequate or incomplete system documentation can create insurmountable communication problems and render the system useless if future users and technicians cannot understand its inner workings. Lack of a post-implementation audit to evaluate the effectiveness of the system and to identify areas where adjustment is necessary can be a costly error just when the system is close to delivering results.

The recognition and acknowledgement of the existence of these frequently occuring problems are the first steps in preventing them from happening. No organization can avoid them all, but careful planning and coordination should minimize their occurence and effect.

Chapter V presented the prevalent views of many prominent individuals in the data-processing and management field concerning the efficiency and cost effectiveness of computer-based management information systems. Of those who questioned the value of such systems, many expressed the belief that too few systems had actually reached the level of attainment that the literature and advocates would have

one believe was possible. Of those that had, it was pointed out that the cost and effort expended in their development was considerable.

Other critics of management information systems criticized the output from them as often being unuseable for its intended purpose, or so voluminous as to be too burdensome to be of value. These critics accuse management information systems of failing to meet their principal objective, that of producing the information needed by management to run the business.

Many individuals with practical experience in the field claim that the desire to be considered modern has caused the management of many firms to acquire hastily and to attempt inappropriately to apply management information systems where they are not needed and will not work.

One critic expressed his concern that management was losing control in many organizations because the computer-based systems generated their own semi-autonomous divisions that were largely oriented toward movements and constituencies outside the organization.

Some who criticize the management information systems concede that they do indeed provide valuable information but that such information is not worth the cost. They point to actual examples and studies where firms have been unable to recover even the costs invested in the system, let alone turn a profit from them. These critics feel that management information systems cost too much; and the results yield far to little tangible benefit.

Finally, Chapter V presents the views of the advocates of management information systems. These individuals stress the obvious

impact such systems have had on the practice of management. They point out that the value of the management information system cannot be easily measured in terms of personnel savings and cost reduction; but that the true measurement of the system must consider the value of the information to management, and the cost of making decisions without that information.

Most strong advocates of management information systems do not dwell on the past achievements and mistakes of systems but on the impact they see emerging now and in the future. They admit problems and mistakes have been experienced in management information systems development; but they feel those problems are being met, and that future survival in this information-packed world requires efficient application of dynamic and responsive management information systems.

Conclusion

This thesis has investigated the many advantages to be realized, and the pitfalls often encountered in the development and use of integrated management information systems. From this investigation it is concluded that, in the modern, complex, information-packed world that management must maneuver in, the computer-based management information system is increasingly becoming a mandatory tool for survival.

Modern technology and the computer itself have aided in the creation of the current "information explosion." In view of the vast amounts of data that are collected and are increasingly required to make meaningful management decisions at all levels of management, it is

unthinkable that management can survive without a systematic method for high speed collection, summarization and analysis of all relevant data required for decision-making. The management information system provides a method for timely collection and processing of data. It allows a larger volume, as well as more up-to-date information to be incorporated into the analysis and evaluation leading to management decisions.

Management information systems employing simulation techniques enable the modern manager to test various alternatives in a "real world" environment before actually applying a given solution to a problem. These systems provide a means for better evaluating and controlling the work of the organization. Real-time management information systems have the capability of displaying up-to-the-minute situation reports, and of allowing the manager to interact with the computer in arriving at the best possible decision for a given situation.

The many advantages that can be gained from use of management information systems does not gainsay the fact that the development of such systems has been fraught with problems. The many pitfalls enumerated indicate the problems that have been encountered. It is apparent from the many quoted views of prominent individuals in the data-processing and management field that too often, poorly conceived and hastily developed computer-based management information systems have resulted in costly, confusing, and relatively useless systems.

Management's desire to employ the latest techniques has often resulted in poorly concieved and inappropriately applied systems. The

technical nature of the computer-based system has often resulted in management's delegation of the design responsibility to the systems design technician. The result has often been a system oriented around the capabilities of the computer rather than the needs of the user. Management's inability to identify the information it requires for decision making, and the technician's inability to fill that void, have resulted in many costly systems that do little more than generate great volumes of useless reports.

It is concluded that many problems have indeed been encountered; and that many costly blunders have been perpetrated in the process of computer-based management information systems development. It is also concluded, however, that the requirement for such systems is growing ever increasingly more vital. Perhaps the generalized data management systems are the answer with their tried and tested programs and more economical development and implementation costs. In any event, despite the problems and pitfalls, it is concluded that even the staunchest critics will agree that future survival in this information packed world requires efficient application of dynamic and responsive management information systems; and that, if systems are developed to meet needs on a sound, economical basis, they can be efficient cost saving, and indispensible tools of management.

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